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Registration of 'Arrowsmith' Hard White Winter Wheat

'Arrowsmith' (Reg. no. CV-969, PI 633911) hard white winter wheat (*Triticum aestivum* L.) was developed cooperatively by USDA-ARS, the Nebraska Agricultural Experiment Station, and the Wyoming Agricultural Experiment Station. Arrowsmith is adapted to dryland environments in western Nebraska and eastern Wyoming. It was released on the basis of its white grain color, medium-long coleoptile length, and tall plant height, all desirable features for wheat grown on dryland sites in the Nebraska Panhandle and eastern Wyoming.

Arrowsmith was derived from the cross KS87809-10/'Arapahoe', made in 1993. KS87809-10 is an experimental hard winter wheat from Kansas State University with the pedigree KS831374-141B/YE1110. KS8321374-141B was a reselection out of 'Karl' (PI 527480), while YE1110 was descended from a cross between 'Gerek 79' (PI 559560), a winter wheat from Turkey, and 'Aurora', a winter wheat from the former Soviet Union. Arapahoe (PI 518591) is a Nebraska developed hard red winter wheat (Baenziger et al., 1989). F_1 through F_3 generations were advanced via self-pollination and maintained as bulk populations. From the F_3 generation, 100 heads were selected and planted as F_4 single-head-progeny rows. Arrowsmith originally was selected from one of these rows as an F_3–derived F4 line, and assigned the experimental number NW97S182. Breeder seed originated from a composite of 30 F_9–derived headrows which were selected for uniformity in plant type and grain color.

Arrowsmith is awned and white-glumed. The glume beak is awned, and the shoulder is elevated. Kernels are elliptical, with a narrow, mid-deep crease, rounded beak and mid-sized to large brush. Grain samples provided to USDA-Federal Grain Inspection Service were classified as hard white, with color characteristics acceptable for this class. Arrowsmith contains less than 0.1% hard red grain and also contains tall variants at a frequency of approximately 0.5%. Coleoptile length (44 mm) is shorter than that of Araphaoe (50 mm), and longer than that of Nuplains (36 mm). Average plant height (90 cm) is greater than that both of Arapahoe (86 cm) and Nuplains (78 cm). Sprouting tolerance of Arrowsmith is less than that of Nuplains; in three Nebraska environments in which sprouting occurred, mean respective falling numbers of Arrowsmith and Nuplains were 168 and 289 s. Hence, cultivation of Arrowsmith is recommended only west of the 100th meridian. Average heading date (day of year 134) in Nebraska environments is identical to that of Arapahoe. Winter hardiness is similar to Arapahoe, and winter survival is adequate for cultivation in Nebraska and similar environments.

Arrowsmith is postulated to carry the *Lr21* resistance gene for leaf rust (caused by *Puccinia recondita* Roberge ex Desmaz.), but is susceptible to current prevalent races. Postulated resistance genes to current races of stem rust (caused by *Puccinia graminis* Pers.: Pers.) include *Sr6* and *Sr10*. Arrowsmith was moderately resistant to natural infestations of stripe rust (caused by *Puccinia striiformis* Westend) in Nebraska in 2001 and 2003. The identity of the resistance genes is unknown. Arrowsmith is susceptible to *Wheat streak mosaic virus*, *Wheat soilborne mosaic virus*, Russian wheat aphid (*Diuraphia noxia* Mordvilko) and the Great Plains biotype of Hessian fly [*Mayetiola destructor* (Say)] but has been rated as tolerant to field infestations of *Barley yellow dwarf virus*.

Arrowsmith was tested in Nebraska breeding nurseries commencing in 1997, the USDA-ARS coordinated Western Plains Regional Performance Nursery in 2000, and in the Northern Regional Performance Nursery in 2000 and 2001. In 62 site-years of the Nebraska Fall-Sown Small Grain Variety tests in 2000–2003, average grain yield of Arrowsmith was 3589 kg ha^{-1}, while respective grain yields of the hard red winter wheat cultivars 'Alliance' (PI 573096) and 'Millennium' (PI 613099) were 3761 and 3845 kg ha^{-1}, and grain yields of the hard white wheats Trego and Nuplains were 3758 and 3432 kg ha^{-1}, respectively. Grain volume weight of Arrowsmith averaged 75.6 kg hL^{-1}, while those of Alliance, Millennium, Nuplains, and Trego were 74.9, 76.4, 77.2, and 76.9 kg hL^{-1}, respectively. Arrowsmith, at 90 cm, was significantly taller than Alliance, Nuplains, and Trego, but not significantly different than Millennium (88 cm). Grain protein content (122.8 g kg^{-1}) of Arrowsmith was equal to that of Nuplains (122.1 g kg^{-1}) and higher than Alliance (113.9 g kg^{-1}), Millennium (119.4 g kg^{-1}), and Trego (117.4 g kg^{-1}).

Arrowsmith was evaluated in Wyoming from 2000 to 2003 (17 site-years). Mean grain yield of Arrowsmith was 2515 kg ha^{-1}, only slightly less than that of 'Buckskin' (2609 kg ha^{-1}) (CItr 17263) and higher than that of Nuplains (2400 kg ha^{-1}). Arrowsmith exceeded Nuplains in height under dryland conditions by 7.4 cm.

The milling and bread baking properties of Arrowsmith were determined by the Nebraska Wheat Quality Laboratory and by the USDA-ARS Grain Marketing and Production Research Center at Manhattan, KS. Mean loaf volume of Arrowsmith (870 mL) exceeded that of Nuplains (828 mL). Dough strength parameters of Arrowsmith are similar to those of Nuplains. Respective mean bake mix times, mixograph mix times, and mixograph tolerance scores (0–7 scale) of Arrowsmith were 4.3 min, 3.4 min, and 3.0 while those of Nuplains were 3.8 min, 2.8 min, and 3.0. Arrowsmith carries the high-molecular weight glutenin subunits 1, 17+18, 5+10. Chinese raw noodle making properties were evaluated by the Wheat Marketing Center, Portland, OR. Texture profile analysis of cooked noodles produced from Arrowsmith gave hardness and chewiness scores of 1222 g and 702 g, as compared with values of 1202 and 743 g for Nuplains. Arrowsmith had poorer color stability, with an L*0-L*24 value of 12.33, as opposed to a value of 9.03 for Nuplains. Based on observations from five Nebraska growing locations in 2003, grain polyphenol oxidase (PPO) levels of Arrowsmith (mean o.d. = 0.67) were similar to those of Nuplains (0.69), but higher than those of the low PPO hard white wheat 'Lakin' (0.29).

The Breeder seed class of Arrowsmith will be maintained by the Nebraska Foundation Seed Division, Department of Agronomy & Horticulture, University of Nebraska, Lincoln, NE 68583. Other recognized seed classes are Foundation, Registered, and Certified, as per AOSCA (http://www.aosca.org/; verified 4 March 2005) standards. Small quantities of seed for research purposes may be obtained from the corresponding author for at least 5 yr from the date of this publication. Seed of Arrowsmith also has been deposited in the USDA National Small Grains Collection, Aberdeen, ID, where it will be available for research purposes, including development and commercialization of new varieties or cultivars. It is requested that the source of this material be acknowledged in future usage by wheat breeding and genetics programs.

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References

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